

National Aeronautics and Space Administration

Office of Biological and Physical Research

**BIOLOGICAL AND PHYSICAL RESEARCH
ADVISORY COMMITTEE**

August 29 - 30, 2002
Washington, D.C.

MEETING REPORT

Bradley Carpenter

Bradley Carpenter
Executive Secretary

Kenneth M. Baldwin

Kenneth M. Baldwin
Chair

BIOLOGICAL AND PHYSICAL RESEARCH ADVISORY COMMITTEE**NASA Headquarters****August 29-30, 2002****MEETING MINUTES****TABLE OF CONTENTS**

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**BIOLOGICAL AND PHYSICAL RESEARCH ADVISORY COMMITTEE
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August 29-30, 2002**

Thursday, August 29

Welcome

Dr. Kenneth Baldwin, Chair of the Biological and Physical Research Advisory Committee (BPRAC), called the meeting to order and welcomed members and attendees. He apologized for the delay in meeting due to the delay in REMAP and OBPR input to the NASA Advisory Council (NAC) meeting.

Review of BPRAC Recommendations

Dr. Bradley Carpenter, Executive Secretary, reviewed the status of the BPRAC recommendations from the last meeting. He outlined the OBPR response as represented in the presentations.

Dr. Guy Fogleman gave the response to the BPRAC request for a briefing on the initiative between the Bioastronautics Research Division (Code U), the Chief Health and Medical Officer (Code AM), and the Office of Space Flight (Code M). Dr. Fogleman explained their process. Code M, represented by Dr. Jeff Davis, develops mission and top-level medical requirements for Code U to address for crew health and safety, implementing operational countermeasures, and delivering medical care to crew members. The requirements are vetted with the medical officer. Dr. Rich Williams provides policy oversight, from the office of the chief medical officer. He reports directly to the Administrator. Code U develops research implementations. The team communicates weekly and works together throughout the process. They have broken down the traditional barriers between the three groups and developed a risk matrix as the basis for prioritizing research solicitations, which are reviewed with the Dr. Davis and Dr. Williams. They have direction to draft a strategic plan for this initiative by January. The committee can request the plan for review.

The committee asked about the Institute of Medicine (IOM) report that NASA was going to use on privacy issues for research on the crew. OBPR is working on research access to the longitudinal study of astronaut health in a way that respects privacy issues. The committee might want to request privacy issues be included in the strategic plan. The Health Insurance Portability and Accountability Act of 1996 (HIPAA) is a standard or framework for protecting patient information confidentiality that is being promulgated in the health care industry. The chair closed that recommendation item.

On the interaction between OBPR and the Office of Management and the Budget (OMB), OBPR went to brief OMB and OMB personnel visited NASA. The new OMB examiner is interested in attending the BPRAC meeting. The committee will be briefed. BPRAC had suggested Education and Public Outreach (E/PO) might be expecting too much for too little. Supplemental outreach grants have been increased from \$5,000 to \$10,000.

Ethics Briefing

Laurie P. Rafferty, NASA Senior Ethics Attorney, discussed ethics for Special Government Employees (SGE). She presented the codes that specified standards of conduct, gifts, the definition of SGE, criminal misconduct penalties, prohibitions on compensation for representation of the government, conflicts of interest and how to resolve them, and impartiality. She presented a list of contacts should questions arise. Committee members do not have to worry about advice they give unless their recommendations would have "direct and predictable" outcomes that would be a conflict of interest.

Subcommittee Reports

Commercial Advisory Subcommittee

Elsa Porter, chair of the Commercial Advisory Subcommittee (CAS), reported on the subcommittee's recommendations. On the recommendation to develop understanding and reduce the antagonism between science and commercial programs, the space centers were working with Stanford researchers on a "knowledge mapping" product, which combines visual images and words, for the fall. The product will show how scientific development and application interacts science and commercial applications and will express the interdependencies.

On the recommendation for policy guidance for increasing commercial space activities in NASA, an example of potential decentralized redundancy was the announcement by the Johnson Space Center (JSC) in May of the establishment of a Flight Commercialization Office independent of the Space Product Development group for the same purpose. The subcommittee recommended a special assistant, with staff co-located in field centers and NASA headquarters, report to the Administrator and standardize policies and coordinate commercial activities as the end line of science and technological development.

The subcommittee recommended NASA add a fifth shuttle flight per year to address the instability to commercial development engendered by the shift in payload priorities when flights are bumped.

The subcommittee recommended that the funding of Space Products Development not be reduced from 5% of the total budget (\$30 million) to 3%. The 5% level of funding has been retained.

Physical Sciences Advisory Subcommittee

Dr. William Bailey Russel, chair of the Physical Sciences Advisory Subcommittee (PSAS), reported on PSAS's findings and recommendations. The subcommittee was concerned about the issues of dissent on the REMAP report and would like to know more about that.

The subcommittee recommended additional funding to develop additional facility instrumentation or modules for the physical sciences on the ISS.

In the review of the advisory subcommittee structure, the subcommittee recommended preserving the current features that function to transmit information up and down between NASA and the research community.

Joint Life Sciences and NASA-NIH Advisory Subcommittees

Dr. Mary Musgrave reported the joint meeting of the LSAS and NASA-NIH subcommittees recommended going beyond the Core Complete configuration for ISS while exploring other research venues. A discussion about activities involved in analyzing trade offs ensued. Dr. Shannon Lucid is looking at the REMAP priorities across Code U. With only three crewmembers, emphasizing putting facilities in orbit risks putting up facilities that can't be used at the expense of science. OBPR is examining trade offs including enhancing crew time through docking the shuttle with the station.

The joint subcommittees wanted to know more about the research opportunities afforded by free flyers. They suggested potentially using the Radiation Health Initiative as an example for continuing to model integration across disciplines. The subcommittees were interested in perhaps participating in the evolution of rules for fencing off research resources from construction funding.

On the subject of the subcommittee restructuring, they, too, recommending retaining the important communication function. They were interested in playing a more proactive role. They also suggested the NASA-NIH subcommittee might be expanded to include other interagency collaborations like NSF, DOE, or USDA. The joint subcommittees commended the E/PO efforts and welcomed the formation of the new Education Enterprise. They cautioned that careful attention should be paid to the interface between Enterprise-level and program education groups.

Space Station Utilization Advisory Subcommittee

Dr. Neal Pellis reported for the Space Station Utilization Advisory Subcommittee (SSUAS). They recommended NASA meet with scientists to define the mission of ISS and recraft the broad ISS mission statement. The subcommittee was concerned about the limited crew time, upmass, and research funding. Crew time is being assessed and a set of goals are being defined working with the astronaut crew office at JSC with science representation. With only four shuttle flights out to 2010, it is a bleak picture. Additional flights cascade additional flight requirements. More crew time means greater support upmass. Dr. Pellis didn't see any new money coming into the programs in the next 5-10 years, except in new initiatives. In response to a question from the committee, he said upmass could be brought up to the station on a Russian Proton. In his opinion, the optimum number of shuttle flights in terms of balancing a complex set of advantages and constraints was between five and six. Mary Kicza commented that recommending the formulation of requirements in this area to the NAC might be helpful. OBPR could decide on the system engineering solutions to NAC's requirements.

The subcommittee was concerned with the REMAP dissent and broad prioritization that would be difficult to translate into a strategic plan. They called attention to inter-Center divisions that inhibited seamless science communication on ISS. They supported more scientists being included in ISS management positions. They also expressed concern about Brazil's delivery of the Express Pallets. They

supported the concept of an onboard science officer. The astronaut crew office has been receptive to the idea of time-optional experiments that can be done in the crew's extra time. The optional experiments would require onboard instructional tools.

Dr. Baldwin censored the chair of the SSUAS for reporting to the Administrator before presenting to the BPRAC, which brings forward recommendations (after vetting) to the NAC to be presented to the Administrator.

Office of Biological and Physical Research Program Overview

Associate Administrator Mary Kicza introduced herself and gave an overview of the OBPR program. She was a civilian with the Air Force and has been at NASA for 20 years. She worked on the shuttle/Centaur at KSC, performed Center management at Goddard, and returned to Headquarters. She discussed OBPR's alignment with NASA's new vision and mission statement. She felt OBPR was strong in its approach to fundamental questions and studying nature's forces in space.

In structuring the FY02 budget and transitioning to full-cost accounting, OBPR developed a baseline budget and reduced requirements. The team consolidated functions to achieve \$60-70 million in savings to plow back into high-priority research and reserves after the emphasis on funding flight facility and rack-level hardware. The ISS Research Capabilities (ISSRC) budget was transferred to OBPR in the FY02 appropriation, and OBPR became an Enterprise. (Space Sciences is the largest Enterprise, with a \$3 billion budget.) OBPR organized around three core themes: biological, physical science, and commercial research and flight support

OBPR is undergoing reorganization. Six weeks ago Ms. Kicza put two deputies in science and program management at the level of the Office of Associate Administrator. Space Product Development was taken out of the Flight Integration Division to eliminate a conflict of interest. In the wake of decentralization of management out to field centers in the 1990s, it was realized that too much decentralization was causing failures. So some program management responsibility is being transitioned back to Headquarters. She is working to establish program management competency within OBPR. They will be having a retreat with Centers in November to define roles and responsibilities. As part of the reorganization, they will be able to hire across Code U in the fall. OBPR is looking to fill six of nine senior leadership positions.

In the FY03 President's budget, reserves have been increased. They are building in 20% reserves on flight hardware development and not less than 10% reserves on operations, depending upon knowledge confidence. The budget includes the Generations and Radiation Health initiatives. The ISS Management Cost Evaluation (IMCE), or Young Report, recommended OBPR engage the scientific community to establish high-priority science objectives and improve scientific productivity. They responded with the REMAP task force. The REMAP report supported the centrifuge as critical to top-priority biological research with '08 being too late for delivery of the centrifuge. They are putting consistent pressure on NASDA to deliver the centrifuge in '07. OBPR was directed to put a Deputy Program Manager for Science in the ISS Program Office. Dr. Neal Pellis has been assigned to the position full time. She communicates with him and Shannon Lucid, Chief Scientist, twice a week.

OBPR has been developing options against the existing baseline to respond to the REMAP prioritization. Dr. Shannon Lucid is integrating research requirements across the Agency and initiated a dialogue with the international partners to develop requirements for their research. The final NAC deliberations on the full report will be September 10-11. They are to report in December on the implementation of REMAP recommendation in relation to ISS as well as the overall structure of OBPR. Eighty percent of the FY02 budget was Priority 1.

They are developing the FY04 budget within baseline and with augmentation following the ground rules that all budget options reflect adequate reserves, ISS facility usage is maximized for high-priority science, lower priority research undergoes phased reduction, and Space Product Development is addressed separately. The preliminary resource requirements have been provided to the ISS program. Approaches to addressing requirements are being examined.

OBPR has received congressional and administrative direction to use a non-governmental organization (NGO) to support ISS utilization. The Utilization Management Concept Development Team was formed March 2002. Options have been developed and reviewed and narrowed to about five. A large part of the community expects an NGO is the right way to go, but that determination has not yet been made. Ms. Kicza's bias is that in scientific and technical leadership, OBPR could benefit from having a more robust

scientific infrastructure out there they could call upon. More debatable is the usefulness in the specific complexities of implementing the ISS program and deciding how much goes forward in what timeframe.

The strategic framework for OBPR aligns with the new NASA vision and mission. REMAP set priorities for the current portfolio. It and the OBPR 5-year vision are guiding budget development. She is working with the NASA Exploration Team (NEXT) to put the short-term picture in the long-term context of where the Agency wants to be going in 25 years. This long-term vision will be the basis for long-term strategic planning of incremental steps and technology investments for the future. The Bioastronautics roadmap is tightly coupled with the Decadal study vision for exploration in 2020. She would like to see the equivalent in the physical sciences. She would like help from the advisory committees in developing roadmaps. She envisions the advisory committees as smaller, more focused, and more proactive in working with her to develop the visions, connect with the science community, and communicate the program goals.

The 5-year vision revolves around two compelling areas: the role of gravity in biological and physical processes and research to enable humans to live and work in space. ISS research would be focused in three major thrust areas: strategic research, fundamental research, and commercial research. Dr. Howard Ross, her deputy associate administrator for science, is working the vision plan with Dr. Neal Pellis in the biological sciences. She would like to see OBPR "Explorer-type" missions like OSS Explorers. She sees free flyers as an additional tool to expand investigators' research opportunities complementary to ISS research and addressing discrete science questions. Free flyers would not take away from the ISS requirement for human-tended research. She would like the education and outreach budget to be 2% of programs and connected to research programs. In response to a question about another shuttle mission, she responded that she believed they were better served by research on the ISS, but they were looking at options for off-station missions. In response to questions, she said the National Space Biomedical Research Institute (NSBRI) was integral to OBPR's research them. Their strategic plan has had a favorable review and the priority of their research was reinforced by REMAP.

OBPR has a study going on to look at research requirements that could be satisfied by free flyers. They could be suborbital, orbital, or deep space vehicles. JPL and Goddard would be implementing Centers. (Goddard has a pre-qualified contract vehicle.) Free flyers might provide up to years of microgravity research time. They may be able to satisfy a requirement for sample return. If the study shows they have the research to justify a program, OBPR will have to develop a competency within the Agency for free flyers for a range of missions. She offered to share the results of the study with the committee and welcomed input. The external community of scientists might make strong advocates of the program should it provide research opportunities.

Ms. Kicza welcomed comments on the advisory committee structure on feedback on the vision. She would like the advisory committee's input for next year's strategic plan.

REMAP Task Force Results

Mr. Lou Ostrach, REMAP Executive Secretary, reported that the REMAP committee would make public their final report on their website September 10 when they present to the NAC. The President's '03 budget called for NASA to work with the Office of Science and Technology Policy (OSTP) on high-priority science objectives. The NAC requested identification of scientific research priorities for the ISS and chartered REMAP. An *ad hoc* task force of scientists reviewed the OBPR portfolio and evaluated and validated the high-priority science and technology research in the portfolio. The NAC will make recommendations based on the report to the Administrator.

Mr. Ostrach defined Core Complete as the Destiny laboratory module configuration scheduled for '04. IP + Core Complete includes the international partners. The enhanced station option includes a crew of six or seven. The Administrator directed REMAP not to consider the budget in their prioritization. REMAP met with the international partners April 19th.

The chair pointed out the REMAP statement on chart 41 of the Executive Summary that if the United States stops at Core Complete, the station could not be considered science driven. He asked where the line would be drawn for priority research at Core Complete. The response was that the medical and biological research could not be fully engaged but require a time-phased approach. The physical sciences would be emphasized for Core Complete. OBPR's strategy is to understand the priorities and maximize the science output with the given facilities. The physical sciences would involve materials, fluids, engineering, combustion, and propulsion questions. REMAP recommended OBPR look into additional shuttle science flights and commercial flight opportunities.

The recommendation to have a science officer was based on the idea that science should be given a voice. Dr. Lucid gave REMAP a presentation on crew involvement in research on station. When additional time is available, a science officer could advocate for science. She is beginning the dialogue on the authority and responsibility of this position and the science officer's role in the command structure.

There was discussion of NSBRI as an example of an intermediate mix of terrestrial and space research. Concern was expressed about planning habitats with the manning and shuttle flight constraints. There was also concern about changing directions, which would undermine researchers investing their careers in space research. Mary Kicza stated that alternative venues would not replace the central emphasis on ISS as a research facility, but serve to complement ISS research. The committee noted that a DARPA model of soliciting research has not necessarily led to a sustainable research community. The peer review model, which supports graduate programs and career lines, is considered progress from NASA's previous research selection process.

The international partners' main concerns were that the Core Complete configuration does not include their modules, and they do not necessarily prioritize research the same way the United States does.

The three primary issues of dissent were that:

1. Significant physical and commercial sciences could be accomplished at Core Complete and the report didn't reflect that.
2. Evaluation of research areas by boxes was constraining and influenced the outcome.
3. The time to evaluate, review, and report was inadequate.

Report on Consolidation of ISS Contracts

Mr. Kristen Erickson reported on the BPRAC request to be briefed on the consolidation of contracts to manage ISS costs. All of the seven consolidated contracts with the exception of the Contract F-Vehicle Sustaining are of a magnitude that can be competed for by small businesses. OBPR will issue draft Statements of Work (SOW) to industry in September to review and respond to NASA will specific intentions to compete. This market survey will help NASA determine set-aside procurements and set socioeconomic subcontracting goals. Small business participation as subcontractors also allows small companies to bring talent and creativity to the ISS program. The committee could be updated in November.

Division Directors' Reports

Space Product Development/Mission Integration

Mr. Mark Uhran, acting director, updated the committee on Space Product Development (SPD). SPD was separated from the Mission Integration Division. They are searching for a director. SPD formulates NASA and industry co-sponsored commercial research and space product development. Their purpose is to demonstrate the competitive advantage of the space environment to industry. They also provide policy oversight and advocate for industry with NASA.

Their budget is about \$30 million. In FY05 the budget chart has a typo on line UPN 500 that should be 17 million not 7. One-third of the workforce they employ is graduate students who participate out of a sense of excitement about space research. Half of their workforce is employees at Commercial Space Centers (CSCs). REMAP acknowledged the need to commercial research and the different criteria under which it should be prioritized. Mr. Uhran reviewed three commercial SPD research payloads that have been flown and future payloads. SPD's accomplishments include the first commercial international consortium doing research for the wood products industry to improve lignan production in wood. Commercial research subsidized the Space-DRUMS facility. He also mentioned large commercial interest by International Scents and Flavors.

Mission Integration Division

Mr. Mark Uhran, acting director, stated that the first constraint of getting into space was always logistics. The Mission Integration Division is responsible for OBPR payloads that involve multiple user systems and support or payloads with content that affects more than one of the other divisions. They integrate NASA-wide, top-level requirements and provide strategic planning consistent with Space Station Utilization Board (SSUB) policies, priorities, and direction. They also develop equipment to satisfy a variety of users. Payload operations integration is the most significant portion of their budget. ISS Payloads Office (Code OZ) improvements are being integrated into the ongoing ISS activities. Code OZ at JSC used to manage the whole program when it was under Code M. They now only manage multiple user payloads.

In FY02 ISS utilization employed about 2,400 civil servants and contractors including people building research facilities. Code OZ at JSC has 24 people.

Physical Sciences Research

Ms. Judith Robey reported on the Physical Science Research Division for Dr. Eugene Trinh. She presented NRA selection, staff, new activities, flight research, and published coverage. Physical Sciences is facing growth in the cost of scheduled ISS research due to launch slips. They have put forward a fundable ISS-based research program with a three-person crew restriction and reduced flights to the ISS. NRA funding wedges for future solicitations in all three primary specific disciplines (Combustion Integrated Rack (CIR), Fluids Integrated Rack (FIR), and Materials Science Reusable Rack (MSRR)) have been reduced to complete the principal ISS Physical Sciences research facilities. They will take \$300,000 out of fluids grants. Some grants selected will be deferred for a year.

Near-term, Physical Sciences is focusing on: increasing strategic NRA funding (in power and propulsion and microgravity influence on living systems), on-orbit research, enhancing peer-reviewed research grant money (from \$85,000 to \$150,000), reducing overhead under full-cost accounting, and implementing the recommendations of the National Research Council Committee on Microgravity Research (CMGR). The final NRC report is due in the next couple of months (Sept/Oct). The BPRAC might request a briefing on how the NRC reports fits in with the REMAP results.

In the commercial arena, the StelSys experiment went up under a commercial banner with integration help from the science group under a NASA cooperative agreement. The selection came through the science side. The company gets the licenses for patents. CAS chair Elsa Porter was interested in this as a case study in how companies connect with NASA research. In this case, NASA had a big interest from an individual from the Johnson & Johnson family looking to space research as a new platform for industrialization.

Bioastronautics Research

Dr. Guy Fogleman updated the committee on the Bioastronautics Division and presented their staff and budget. The President's budget for 2003 brings the division back up to levels preceding the previous year's budget cuts. However, programs were reduced to increase reserves. In the new budget environment, they have shifted to more short-term focus. Rather than risking spreading funds too thin, the division made some hard decisions about cutting programs. They are down to one National Space Center of Research and Technology (NSCORT) at Purdue. This year's \$11.7 million in earmarks were funded. A placeholder wedge of research funds in Code U is being held for distribution after REMAP.

REMAP recommendations were made public in July. The final report is being mailed to the NAC Friday, August 30. Division directors have not seen the report. Of the five categories of research effort in Biomedical Research and Countermeasures (BR&C) and Advanced Human Support Technology (AHST), four were in Priority 1, or 96% of their budget. (Environmental health was one level above termination.)

Dr. Fogleman presented the Radiation Health Initiative, which studies how to protect humans from radiation damage in low-Earth orbit and mitigate risks to the ISS crew. The Senate has approved \$10 million next year ramping up to \$28 million. Pieces of the initiative will be integrated across the three divisions: biomedical research and countermeasures, physical sciences (looking at radiation protection and shielding), and fundamental space biology radiation research. If the initiative passes the budget process, they will have more money for radiation proposals, but they will be releasing NRAs for radiation research either way.

NASA and DOE signed a Memorandum of Agreement (MOA) in January 2002 for cooperating on radiation research. (NASA contributes \$.5 million the first year and \$1 million subsequently; DOE contributes \$5 million.) Six of the 17 proposals DOE selected for research were chosen by OBPR for joint supplemental funding, thus leveraging NASA's investment. In addition, NASA and NIH are planning joint initiatives in biomedical research.

Dr. Fogleman reviewed NRA releases and selection. BR&C, AHST, and the Fundamental Space Biology (FSB) programs will release their annual NRAs simultaneously on January 15, 2003. There was some discussion of the harm to the research community from deselecting proposals. Dr. Fogleman concurred that it sent a bad message and was not their normal process. He said they needed to better formulate and stabilize their long-term plans.

The NSBRI strategic plan and concept was endorsed by their review panel. This and the REMAP prioritization will influence how the Institute is funded. They intend to work within Code U to keep

NSBRI's funding level at no lower than \$30 million. Dr. Fogleman said he could make the report on NSBRI and response available to the committee, but because of included proprietary information, the committee would have to request the Strategic Plan from NSBRI. In response to a question, he said the NSBRI does not receive a lot of direct dollars from outside sources, but it leverages laboratories at universities and member institutes. He suggested a presentation by the director.

In response to a previous BPRAC request, Dr. Fogleman briefed the committee on the interactions between the Bioastronautics Research Division (Code U), the Office of the Chief Health and Medical Officer (Code AM), and the Office of Space Flight Deputy Associate Administration for Crew Health and Safety (Code M). Dr. Fogleman represented Code U; Jeff Davis, Code M; Des Lugg, Code AM, and John Rummel, JSC. They have continued meeting on a regular basis and have been charged with developing an integrated Bioastronautics Strategic Plan by January 31, 2003. They have defined risks to the mission and crew to help prioritize research that may help mitigate the risks. Of the 19 NRAs selected in this area, 4 were classified as operational medicine. The committee commented that was a significant increase in funding over last year and shows an evolution in translational research becoming part of the research portfolio. They would like to see the process institutionalized so as not to be dependent on individuals.

Dr. Fogleman highlighted other ground and flight activities. Four new experiments began on Increment 5, the Expedition 5 crew launched June 5, 2002. In response to a question about how much earmarks contributed to the program, Dr. Fogleman said it varied widely. Some programs take their relationship with NASA seriously; for others, NASA is just a pass-through. They are working on engaging these programs to return something of value.

Fundamental Space Biology

Dr. David Liskowsky, acting direction of the division, gave an update on the Fundamental Space Biology (FSB) Division and provided additional detail related to fundamental space biology issues. They currently have five staff members and two new staff members. They are looking for a director.

Dr. David L.

They are looking at budget options in response to REMAP. The cell molecular biology, organismal and comparative biology, and the advanced life support component of gravitational ecology were Priority 1. Developmental biology was Priority 2. Evolutionary biology and the fundamental science component of gravitational ecology were Priority 4, perhaps they were newer elements and not as well explained. The R&T component of the budget funds their grants, of which 51% goes directly to PIs. The ISSRC component builds ISS hardware. In response to the \$1-billion cut last year, they defined an ISS Biological Research Project Core consisting of the habitat holding racks; the incubator; cell culture unit; and Canadian insect habitat, NASDA centrifuge, and life sciences glovebox support. The animal and plant habitats were not covered because of the cost cuts, but FSB developed a plan for building them in a phased approach should they receive the funding. So their first priority is funding the core facilities and phase 1 of the advanced habitats. They also determined to increase earlier ISS use through Express Rack access. They are looking for a funding wedge from the Radiation Health and Generations initiatives.

The Generations initiative is internally generated, not peer-reviewed research, with a focus on cell molecular biology long-term adaptations to space, with secondary fundamental science and health risk mitigation issues. The study looks at the adaptation of organisms to the space environment over multiple generations and the capacity of terrestrial life to evolve in space. There is \$11.2 million in the FY03 budget for Generations. If it is fully funded, it would triple the R&T budget. In response to a question about how Generations fits into REMAP priorities, Dr. Liskowsky responded that they are looking at high-priority questions and ISS capability for guiding decisions as they go forward. They plan to reconstitute their science working group (SWG) that was disbanded last winter due to budget cuts.

The Biomass Production System prototype plant unit was flown successfully on ISS Increment 4. One of the plant chambers malfunctioned, but the science and engineering objectives were met. There was some discussion of the environmental control of the unit and the need for the centrifuge as a control to show that effects were caused by lack of gravity. There was also a discussion of redundancy with commercial facilities. Some of the governmental facilities are the distillation of the requirements of the scientific community rather than specific purpose as the commercial equipment usually is. Both commercial and government hardware are advertised in NRAs if they are available for PIs to use, so PIs can choose which is most useful to them. Dr. Liskowsky offered to provide the report on the research..

Code U is undertaking a new initiative studying free flyers for supplementing ISS research. They need to explore requirements to see if it would be a useful complement to the ISS. They would request a start in '04 for the FY05 budget if they decide they want it. They are at the beginning of gathering

information to explore possibilities. A free flyer workshop in June was for talking about requirements. Some of the options are collaborations, BION, ELVs, and other vehicles. The BION '05 flight is probably too soon, but there are possibilities for '07 and '09 as part of this initiative.

A Federation of American Society of Experimental Biologists (FASEB) report asking for an increase for investigator-initiated research for OBPR went to the Hill.

Friday, August 30**ISS Utilization Management Concept Status**

Mr. Mark Uhran provided an update on NASA's response to congressional direction to implement management of ISS research with an Non-Governmental Organization (NGO). The ISS Utilization Management Concept Development Team was established in March 2002 to examine detailed options for management of ISS research. A Blue Team chartered in March 2002 baselined the current agency ISS utilization process, organizational interface, and management framework. They have characterized every WBS element of ISS management as "inherently governmental," "appropriately governmental," or "other." The Red Team process has two phases. The first part was the technical review, and it was successfully presented to Ms. Kicza. Red Team II will review outcomes, for example, on the workforce. Workforce numbers include sustaining engineering for payloads, but not for station vehicles. There are over 2,000 workers employed in utilization functions at Marshall, Johnson, Ames, Kennedy, JPL, (Goddard, Langley), and Headquarters at a cost of \$300 million a year. Potential NGO workforce numbers are still under review. The transition to using an NGO would be 3-4 years. They only anticipate transferring 50-250 people, but some time must be spent considering core competencies and other human capital considerations.

Mr. Uhran presented the five options being considered:

- Baseline
- Reinvent NASA
- Institute
- G-Corp
- FFRDC

The team will present their final report with the Red and Blue Team deliberations in appendices. Efficiency gains are not part of the final report. Companies bidding on a contract would have to make an argument for efficiency gains. The report will go to Center directors in mid September, to the Hill for feedback, and to the Administrator. Ms. Kicza is looking for reviews by the advisory committees on decision like the number of variables that should transfer external to NASA.

International Space Station Research Status

Dr. Neal Pellis, OBPR Program Scientist for ISS, reviewed the ISS vision and mission statements, which are being reworked. The program scientist position was created in response to an IMCE report recommendation to maximize science research product during station construction and assembly. Research is getting more emphasis with the change in management of the ISS. An example is the shuttle arm being taken off a shuttle flight instead of science payloads when a gyro weighing over a ton needed to be brought up to ISS as a replacement part.

There is a new level of enthusiasm in the crew, who see research as an investment in their future from the perspective of both health and preserving support for ISS. Astronaut Jim Voss is heading a committee working on new strategies to release up to 30-50% more crew time to research activities. The committee asked about the validity of crew time estimates. Dr. Pellis responded that Dr. Lucid was a positive presence to get to ground truth. Anomalies occur and intrude on the 20-hour astronaut schedule. Crews generally work 12-hour days. Work assignment is 6.5 hours available to be scheduled every day. They have reached 15-17 work hours in a week. It is more often 12. Based on international agreements, two of the crew will be Russian, whether that crew is three or six. Resources have been "fenced off" for experiments: 20 hours/week, five middecks, 500W of power on ascent and descent, and 400 hours of preflight training.

Some of what has been learned is the need to respond to a changing environment, to build contingencies into experiments, and the difficulties in communication back and forth during anomalies. Code U needs to take a look at optimal usage and subscription rate of the facilities that are up there. Although the station during assembly phase is less productive than the shuttle, this is the second year of continuous research operations on the ISS and 600 crew hours have been spent on 52 investigations.

The committee commented on how the ISS research was being represented. They worried the research results were being over sold. The research could be called pathfinding or advanced, but not cutting edge. Dr. Pellis agreed that NASA had to be strategic in how it marketed station research. He pointed out the effects of physical forces like vibration, which affect physiology, had to be understood to differentiate them from the effects of microgravity. He observed that the Physics of Colloids in Space was a unique experiment that could only have been done on station and had significant results. Health in long-duration spaceflight is another unique area. To go from concept to publications, space research can take 11 years. Research requires a series of experiments to get a complete dataset. On ISS, researchers can complete a series of experiments in 180 days that might take years of shuttle flights.

Crew training time is always an issue. Onboard training is increasing, including electronic devices, videotapes, and combining pre-flight training and electronic onboard training. He reminded the committee that the same person would be doing the immunoassay and assembling port side thrust.

Performance Measurement and Strategic Planning

Mr. Christopher Flaherty showed the interaction and configuration of NASA's strategic plan, OBPR's strategic plan, program plans, roadmaps, research announcements, the budget, and research plans including inputs from the REMAP, the NEXT team, and the NRC. NASA will complete a new strategic plan in a year that relies heavily on inputs from the divisions, codes, and Enterprises.

OBPR is looking for feedback from the BPRAC on the ways that OBPR traces into vision and mission. OBPR would like comments on the descriptions of the major questions, Mary Kicza's 5-year plan, and the performance report. The committee will provide feedback on Mary Kicza's presentation of the 5-year vision to the Chair Kenneth Baldwin by October 1. He will incorporate the comments into a single document to be emailed back to the BPRAC committee for final editing. The commentary will be sent back to Code U by October 15.

The final performance report will be sent to the committee in October. There will be a conference call to review the report. BPRAC can forward their review of the performance report to the NAC for December. The performance targets were determined by the Agency for '04. They are closely aligned with the budget, which goes to the Congress in January. So the next meeting would be the window to have input on the following year's performance targets.

NASA Exploration Team Activities

Harley Thronson, Lisa Guerra, and Gary Martin represented the management leadership of the NASA Exploration Team (NEXT) in Codes S, U, and M. NEXT was chartered in 1999 to create an integrated strategy for space exploration across the entire Agency that would be driven by science questions, not destination. The idea was to break down barriers between Centers and Enterprises and weave a long-term strategy for getting humans out of low-Earth orbit. They develop alternative scenarios, architectures, and mission concepts and identify gaps in technology development in roadmaps as well as driving out opportunities and needs.

The challenges are so hard that they can't just be pushed through: it requires revolutionary, not evolutionary new technology approaches. The Radiation Health Initiative (RHI) was a new initiative advocated by NEXT, also the In-Space Propulsion and Nuclear Systems Initiative. The Generations initiative had humble beginnings in NEXT, too. NEXT has systems engineering and advanced concepts teams. They have working groups in science, transportation, human and robotics, revolutionary advanced technology (led by JPL), and human subsystems (led by Code U).

The long-term NASA vision entwines the futures of science and human space exploration. Science drives destinations. They are developing progressive capabilities to go to many strategic locations. The destinations are stepping stones in the long-term strategy starting with low-Earth orbit (LEO) (defined as Earth's neighborhood bordered by libration points (send large observatories out there)), then accessible planetary surfaces (Mars, asteroids), then sustainable planetary presence. Robots are seen as the trail blazers. The hurdles they see are transportation, power, crew health and safety. They invest their small budget in analyses and technology or stratagems to break paradigms and get past these hurdles.

The committee was interested in NEXT's resources and support. NEXT briefed the Administrator in February. Their materials were part of the NASA retreat activity and influenced the mission statement. Fred Gregory was an influential signatory on their original MOA. As deputy administrator, he is now their main point of contact in the front office. The committee would like to see more reports from NEXT.

Review of Issues, Findings, and Recommendations

The final recommendations are included in Appendix D.

**APPENDIX A
AGENDA****BIOLOGICAL AND PHYSICAL RESEARCH ADVISORY COMMITTEE MEETING
NASA Headquarters
PRC
Washington, D.C.
August 29-30, 2002****Thursday – August 29**

10:00 A.M.	Welcome/Chair's Review of Agenda/Logistics	Dr. Baldwin
10:10 A.M.	Review of BPRAC Recommendations	Dr. Carpenter
10:20 A.M.	OBPR Program Overview	Ms. Kicza
11:30 A.M.	Administration Perspective	Mr. Sponberg
12:30 P.M.	Lunch/Ethics Briefing	Ms. Rafferty
1:30 P.M.	REMAP Retrospective	Ms. Kicza/Dr. Ostrach
2:30 P.M.	Division Directors' Reports	
	Space Product Development/Mission Integration	Mr. Uhran
	Physical Sciences Research	Dr. Trinh
	Bioastronautics Research	Dr. Fogleman
	Fundamental Space Biology	Dr. Liskowsky
5:00 P.M.	Subcommittee Reports	
6:00 P.M.	Adjourn	
7:00 P.M.	Dinner	

Friday – August 30

8:00 A.M.	ISS Utilization Management Concept Status	Mr. Uhran
9:00 A.M.	International Space Station Research Status	Dr. Pellis
10:00 A.M.	Performance Measurement & Strategic Planning	Mr. Flaherty/Mr. Allen
10:30 A.M.	NASA Exploration Team Activities	Ms. Guerra
11:00 A.M.	Review of Issues, Findings, and Recommendations	Dr. Baldwin
12:00 P.M.	Adjourn	

APPENDIX B
BIOLOGICAL AND PHYSICAL RESEARCH ADVISORY
COMMITTEE (BPRAC) MEMBERSHIP

August 2002

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APPENDIX C MEETING ATTENDEES

Committee Members

Ken Baldwin, Chair	UC-Irvine
Nick Bigelow	U. Rochester
Bradley Carpenter, Executive Secretary	NASA
Tom Daley	USN
G.M. Faeth	U. Michigan
Colette Freeman	NIH/NCI
Leroy Gross	EVMS
Bernard Harris	The Harris Foundation
Walter Hill	Tuskegee University
J. Milburn Jessup	Georgetown
Alex McPherson	UC-Irvine
Ron Merrell	VCU
Mary Musgrave	U. Massachusetts
Elsa A. Porter	Meridian International Institution
Bob Richardson	Cornell University
W.B. Russel	Princeton University
Jay Sanders	The Global Telemedicine Group

NASA Attendees

Peter Ahlf	NASA Headquarters
Rob Askew	MSFC
Marc Augh	NASA Headquarters
John Charles	NASA JSC
Larry Chambers	NASA Headquarters
Francis Chiaramonte	NASA Headquarters
Corky Clinton	NASA Headquarters
Sharon Cobb	NASA Headquarters
Kristen Erickson	NASA Headquarters
Chris Flaherty	NASA Headquarters
Guy Fogleman	NASA Headquarters
Ray Gavert	NASA Headquarters
Elizabeth Gonzalez	NASA Headquarters
Bruce Hather	NASA Headquarters
Mary Kicza	NASA Headquarters
Merrill King	NASA Headquarters
Knudson	NASA Headquarters
Dave Larson	NASA Headquarters
Candace Livingston	NASA Headquarters
Gary Mazlin	NASA Headquarters
Louis Ostrach	NASA Headquarters
Neal Pellis	NASA Headquarters
Alex Pline	NASA Headquarters
Gerald Pitalo	NASA Headquarters
Laurie Rafferty	NASA Headquarters
Judith Robey	NASA Headquarters
Howard Ross	NASA Headquarters
John D. Rummel	NASA Headquarters
Pat Russell	NASA Headquarters
V. Schneider	NASA Headquarters
Harley Thronson	NASA Headquarters

Other Attendees

Russ Bardoes
Andrew Bradley
Keith Cowing
Clay Forshee
Vladislav Golovin
Carl Grastaferro
Stephanee Hardy
Joanne Hopkins
Alan Lady
Pam Moore
Frederic Nordwind
Lara Pierpoint
Patricia Russell
Perry Stabekis
Jennifer Trexell
Jennifer Wiseman

SpaceHab
USRA
NASA Watch
Unisys
Embassy of Russia
InDyne, Inc.
DFI International
SRI International
Zero Gravity Corp
Capitol Publications
ESA
NRC Space Studies Board
USRA/NIAC/ASGSB
Windermere
DFI International
House Science Committee

**APPENDIX D
FINDINGS AND RECOMMENDATIONS**

Biological and Physical Research Advisory Committee

Recommendations to the NAC:

1.) REMAP Dissent

Finding: The REMAP report has provided the NAC and NASA with a prioritization of research to be carried out on the ISS that is based uniquely on scientific merit. There has been significant dissent from within the REMAP Committee concerning the report, and the BPRAC is concerned as to the nature of this dissent and as to how the NAC and NASA will integrate the dissent into implementation plans.

Recommendation: A public response to the REMAP committee dissent should be an integral part of the NAC and NASA reactions to the REMAP report.

2.) REMAP Implementation.

Finding: The REMAP report provides the NAC with a prioritization of research to be carried out on the ISS that is based on an evaluation of scientific merit. The NAC will review this report and pass on to NASA a final set of recommendations on ISS research priorities. The mechanisms through which NASA will implement these scientific priorities within the constraints of the capabilities of the ISS (at core complete, and beyond) are not yet defined. For example, absence of the plant and animal habitat and lack of the large rotor centrifuge would severely constrain the types of experiments that could be accomplished. Until an ISS configuration equivalent to the Rev F ISS assembly is achieved, the complete program objectives cannot be met on ISS.

Recommendation: NASA should balance the scientific priorities against probable ISS capabilities (crew resources, facilities, up-mass capabilities, ISS lifetime, etc.) so as to optimize overall scientific yield. In doing so, NASA should seek continuing guidance from the scientific community. NASA is also encouraged to develop new strategies and initiatives for achieving OBPR scientific goals aboard the ISS.

3.) Commercial Space Development Activities

Finding: Commercial space development activities in NASA are increasing. These activities occur in many parts of the NASA organization and lack central policy guidance and coordination. Moreover, individual PIs increasingly are seeking to establish business relationships with private sector investors without uniform guidance from NASA on appropriate legal matters such as patents, licensing, trademarks, and procurement.

Recommendation: The NASA Administrator should address the status of the commercial programs and develop standard policies and coordinate them. The assistant to the administrator for Commercial Development should have designated staff co-located in field centers and headquarters offices throughout the Agency to facilitate communication and cooperation in all these endeavors.

4.) The Science Officer On ISS

Finding: The NASA Advisory Council (NAC) has chartered the Research Maximization and Prioritization Task Force (REMAP) to identify and establish scientific research priorities for the OBPR/Agency. The key element for success of the ISS program is the effective utilization of science. REMAP has recommended that for each ISS increment one crew member should be designated as the "Science Officer."

Recommendation: The BPRAC endorses the designation of a "Science Officer" to drive the importance of science to the ISS. The Science Officer would strengthen the science priority and provide the basis for

increasing productivity. The roles and responsibilities of this new designation must be clearly defined to guarantee that overall science utilization is increased.

Recommendations to OBPR:

1.) Research Funding Wedge

Finding: When redistributing limited financial resources within the Physical Sciences at OBPR, decisions are now being made that trade off funding of new or continuing peer-selected research projects against the completion schedule of key ISS facilities. The impact of these decisions will result in a dramatically reduced funding rate of proposals solicited in 2001/2002 NRAs and may impact FY04 funding rates. If this strategy continues, it will have a destabilizing effect on OBPR's research community.

Recommendation: OBPR should return to a strategy in which research funds are protected against the last-minute financial stresses of ISS facility implementation.

Discussion: That facility choices that were made were invisible to committee. These trade-off decisions represent a change in strategy. OBPR's strategy to add reserve funding should help stabilize the budget.

2.) OBPR Explorer Missions and Free Flyers.

Finding: Although the ISS is the primary research platform, completing the research portfolio of OBPR may lend itself to synergistic activity on complementary platforms. A significant impediment to the development of the OBPR scientific and commercial research program is limited access to space for experiments. As a result, ways to increase access to space are critically needed, and the BPRAC strongly supports the efforts of OBPR to consider the use of new space platforms for experiments, e.g., OBPR Explorer missions patterned after OSS Explorers using free-flying spacecraft.

Recommendation: BPRAC requests further briefing about OBPR plans concerning Explorer missions and the potential use of free flying spacecraft as new platforms for OBPR experiments in space and requests a briefing about the quality of the environment and type of experiments, budgeting, impacts on station research, and alternatives at its next meeting.

3.) IOM Recommendations Implementation

Finding: The IOM contract on Space Medicine made numerous recommendations with regard to operational medicine.

Recommendation: The BPRAC requests a briefing on the implementation of the IOM recommendations at its next meeting.

4.) Privacy of Astronaut Medical Research Data

Finding: The committee has expressed concern in the past with regard to the interaction of research interests and the operational medicine program. We understand the current structure and functions are vastly improved. We congratulate NASA for the progress made on this important issue.

Recommendation: The Committee requests a formal presentation on the potential conflict between medical privacy and research data needs in projects involving astronauts. BPRAC requests regular reports on the Code M (Operational Medicine), Code AM (Chief Health Officer) and Code U organization and function/interaction.

5.) Consolidation of Contracts

Finding: NASA has done a good job of providing opportunities to small businesses. The BRAC looks forward to a follow up status on the IMCE recommendations to consolidate contracts. The committee

reaffirms its concern that the consolidation of approximately 40 contracts into 7 contracts will 1) decrease prime contracting opportunities for small business, 2) serve as a motivational impediment to small organizations' and institutions' access to OBPR research opportunities, and 3) foster perceptions of NASA being a "closed shop." OBPR promises to provide the committee a report at the November BPRAC meeting. The next meeting is not scheduled until February 2003.

Recommendations: The committee recommends a status report be provided to members of the committee preliminary to the November teleconference for a decision on closure.

6) Providing Funding Estimates on NRA Announcements

Finding: Information was presented to the BPRAC that NRAs were being released for which there was virtually no funding available.

Conclusion: By funding little to no proposals on an NRA, the research community would be quickly discouraged from any future response. It is furthermore unfair to those PIs that commit a significant amount of time and effort in preparing proposal in which little funding is available.

Recommendation: OBPR should provide some estimate of either the funds anticipated to support a specific NRA or an estimate of the number of proposals likely to be supported at the time of NRA release.

7.) Near- and Long-Term Visions

Finding: The associate administrator and individuals involved in the NEXT Initiative presented their assessment of OBPR's relevance to the NASA mission and vision of Code U's role in the present, near term and long term. The timeframes presented were a near-term vision representing 5 years out and the long-term vision representing 25 years out.

Recommendation: The committee fully concurs with this vision and requests continuing briefings on the implementation of this vision. The committee also concurs with the timeframe of the near-term and long-term vision.

8.) ISS Utilization Management

Finding: Mr. Mark Uhran reported the status of the ISS utilization management concepts. (This study was previously referred to as the ISS Research NGO.) This effort will provide options for the management integration of research for ISS, a 2,000 plus FTE/WY task. Code U has directed teams to provide detailed criteria for the work needed to accomplish research management/integration and for options to accomplish this work.

Recommendation: The committee recognizes the thoroughness of this evaluation and considers it appropriate for the importance of this decision. The committee would like an additional briefing on the recommended option(s) for ISS research utilization management prior to a final decision. BPRAC wants to be part of the consultation process (prior to RFI).

**APPENDIX D (CONT.)
FINDINGS AND RECOMMENDATIONS**

Joint Life Sciences Advisory Subcommittee/NASA-NIH Advisory Subcommittee

Complete Program vs. U.S. Core Complete

Finding: Few of the high priority science objectives identified by REMAP in the life sciences can be pursued on the US Core complete configuration of ISS. Absence of the plant and animal habitats, lack of the large rotor centrifuge would severely constrain the types of experiments that could be done. At the same time, remaining at a 3-person crew would so limit crew time available for conducting experiments that few of the high priority science objectives could be met. Until an ISS configuration equivalent to the Rev F ISS assembly is achieved, the complete program objectives cannot be met on ISS.

Recommendation: ISS assembly should continue beyond core complete. In the interim, additional flight opportunities on the shuttle should be sought, and a vigorous ground-based program should be supported.

Free Flyers

Finding: Free flyers have been frequently mentioned in previous committee meetings as a means of extending the flight opportunities available for OBPR research portfolio. However, little detail has been given to the subcommittees regarding the specifics of these free flyers. In particular, the quality and type of experiments that can be performed on these platforms is unknown.

Recommendation: Given the scarcity of flight opportunities, LSAS supports exploring the utility of the international FY05 free flyer or other BION-type vehicles to enhance research opportunities in the life sciences. A full briefing on all types of free-flyers under consideration is requested at the next meeting.

Integration Across Disciplines

Finding: Integration across disciplines is very important in a number of life sciences areas in Code U, however no mechanisms for carrying out the management of this integration have been proposed. Because the new radiation initiative will augment resources in three different areas of Code U research, it represents an obvious test case for this management challenge.

Recommendation: The subcommittees recommend that cross discipline integration be given greater management priority, and requests a presentation on strategies that will be used to enhance cross-discipline integration across Code U, perhaps using the radiation initiative as an example.

Rules for Fencing Research Resources

Finding: At the last meeting, the transfer of ISS funds from Code M to Code U was announced. At that time the subcommittees were informed that some rules and regulations would be developed dealing with the "fencing" of these funds within Code U. It is crucial to have adequate funding for carrying out the research mission while at the same time building the research capabilities on ISS.

Recommendation: These advisory groups should participate actively in the development of these rules and regulations and not be informed of the decisions after the fact.

NASA/NIH Interaction

Finding: Only very minimal information was presented in the briefing regarding the NASA/NIH interaction. The subcommittees have observed that interest from NIH in the advisory meetings has waned over the years. The group feels that there is tremendous potential for interagency interactions in general, and especially rich possibilities exist in the biomedical research areas shared by NASA and NIH.

Recommendation: Better use should be made of the subcommittee in fostering these interactions. The groups suggest broadening the subcommittee's purview to include other interagency interactions (such as with NSF, DOE, and USDA). At the same time, the administration should actively encourage participation of appropriate personnel from the target agencies.

Recast Role of Advisory Groups

Finding: Members of the subcommittees listed a variety of problems with the current advisory process. These included lack of focus for their activities at a meeting, short time available to digest materials briefed at the meetings, lack of continuity between meetings. The groups noted with interest the new associate administrator's five year plan, which includes revision of the advisory groups, and wants to provide support for this activity.

Recommendation: As advisory committee roles are recast, important functions provided by the groups should be retained. These include broad representation of discipline expertise to the agency and communication of NASA's goals, challenges, and directions to the constituent scientific communities. The committees request clear charges with associated tasks, as well as better pre-meeting distribution of information to be reviewed.

Education Enterprise

Finding: The subcommittees were very impressed by the excellent educational and public outreach materials developed in conjunction with STS-107. Further, the elevation of NASA's education mission to the enterprise level is remarkable.

Recommendation: Careful attention to how OBPRs existing excellent effort in education and outreach will interface with the new enterprise is crucial. A briefing is requested at the next meeting.

**APPENDIX D (CONT.)
FINDINGS AND RECOMMENDATIONS**

Physical Sciences Advisory Subcommittee

1. Finding: The PSAS has not seen the full REMAP report but understands that a significant number of the members of the REMAP committee have dissented from the recommendations.

Conclusion: Given that the recommendations will affect priorities for the research program in the physical sciences, we are concerned about this dissention and would like to understand the situation.

2. Finding: REMAP priorities did not address the actual capabilities to support research or lifetime of ISS. To realize the full potential of the investment in the ISS the research program should be optimized in recognition of both.

Recommendation: NASA should expend funds on experiments and facilities in recognition of the expected capabilities such as crew time on the ISS in a way that optimizes the research output over the lifetime of the ISS.

3. Finding: At present the Physical Sciences have no funds for development of additional facility instrumentation or modules beyond those currently on the docket. Either continuing experiments with only the existing instrumentation or allowing the facilities to sit idle does not make full use of the investment in the ISS.

Recommendation: Additional funding must be found.

4. Finding: The PSAS committee structure has functioned effectively in transmitting information up and down between the NASA administration and the PIs. With the appointment of a new Associate Administrator we recognize the need for a review and, perhaps, restructuring of the advisory committee structure.

Recommendation: Expansion or restructuring of committee responsibilities could be worthwhile but should preserve features of the current structure that facilitates communication with diverse scientific communities.

**APPENDIX D (CONT.)
FINDINGS AND RECOMMENDATIONS**

Commercial Advisory Subcommittee

1. Finding: The Commercial Space Center (CSC) program, initiated in 1985, has successfully involved a large number of private organizations in fulfilling the congressional mandates to explore the commercial use of space to enhance U.S. economic goals. An additional benefit of the CSC program has been the significant leveraging of NASA funds as a result of the commercial funding contributions to the total effort. The advent of the ISS provides opportunities for long-term, human-tended experiments required by most commercial research efforts that were not available in the past.

Recommendation: That the Space Products Development Division and the Commercial Space Centers explore the technique of "Knowledge Mapping" to develop appropriate plans to assure that future commercial space research programs would most effectively utilize the available NASA and private resources so as to make the kind of contributions to the U.S. economy envisioned in the congressional mandates.

2. Finding: Commercial space development activities in NASA are increasing. These activities occur in many parts of the NASA organization and lack central policy guidance and coordination. For example, Johnson Space Center recently (May 15, 2002) announced the establishment of a Flight Commercialization Office independent of the Space Product Development office at Marshall Space Flight Center. Moreover, individual PIs increasingly are seeking to establish business relationships with private sector investors without uniform guidance from NASA on appropriate legal matters such as patents, licensing, trademarks, and procurement.

Recommendation: That the NASA Administrator address the status of the commercial programs and develop standard policies and coordinate them. The Assistant to the Administrator for Commercial Development should have designated staff co-located in field centers and headquarters offices throughout the agency to facilitate communication and cooperation in all these endeavors.

3. Finding: It has become increasingly clear that the major impediment to research on the ISS for all users in the near future is the lack of sufficient upmass to the station. With only four shuttle flights per year, long planned research payloads are being removed to make room for payloads needed for station maintenance and repair. The absence of stable logistical planning, in turn, wreaks havoc on the ability of Commercial Space Centers to maintain and serve their industrial partners. Moreover, the process used to for deciding what goes and what does not, involving years of work and millions of dollars, is unclear to line personnel and the research community.

Recommendations:

a. That the research community be informed of the process and criteria used to decide the allocation of user upmass, particularly for powered lockers.

b. That funding be sought from Congress to support an additional shuttle flight dedicated to research priorities.

**APPENDIX D (CONT.)
FINDINGS AND RECOMMENDATIONS**

Space Station Utilization Advisory Subcommittee

ISS Mission Statement

Findings: The SSUAS and the IMCE Committees have requested that prioritization of research on ISS involve clear articulation of the mission of the ISS and that research and other uses of the ISS be based on the mission or prioritized missions of ISS. The SSUAS notes that such an identification of mission was not achieved by the REMAP. At two previous SSUAS meetings (Recommendation #1 in February 2002 and Recommendation #1 in July 2001), we recommended formulation of a mission statement.

Conclusion: The Committee believes a mission statement is essential before research can be prioritized. The SSUAS continues to be concerned that the avoidance of definition of mission leads to an unwieldy assortment of investigations that are not well integrated into an overall plan for ISS. For instance, the insistence on a centrifuge without definition of that centrifuge in terms of its impact on the vehicle or its return for science may reflect the constitution of the REMAP committee rather than an objective review of the mission of ISS and the research to support that mission.

Recommendation: The SSUAS recommends that scientists from the user community that includes codes Y, R, S, M and U as well as the public sector meet with NASA to define the US mission(s) of the ISS and the research priorities that devolve from such mission(s). The SSUAS recommends the creation of a defined set of integrated research areas that have a finite time for completion, are multidisciplinary, fit into the current constraints of ISS but have focused implications.

Limited Crew Time, Upmass, and Research Funding

Findings: The REMAP Committee has recently released its Executive Summary of its study of prioritization of the research to be conducted in OBPR, including its research on ISS. The REMAP Committee not only spoke to the research to be conducted on ISS but a number of other concerns that limit the utilization of ISS.

Conclusion: The REMAP did an excellent job in outlining the constraints that crew time, upmass, graduate education, research program and grants management support, flight frequency and mission planning place on ISS capabilities that the SSUAS has also drawn attention to over the years.

Recommendation: The SSUAS joins the REMAP Committee in encouraging NASA to address and fix these constraints to research utilization immediately.

Fifth Shuttle Flight Per Year

Findings: Both the REMAP and the presentations to the SSUAS indicate that severe constraints on upmass will limit scientific payload delivery in the next year to as little as 7 Kg in the worst case scenario and less than 50% of the high priority research payloads in the years following US Core complete.

Conclusion: This limitation on the amount of scientific upmass so severely constrains the use of ISS that it greatly diminishes its value as a research platform.

Recommendation: NASA should make every effort, including redirection of internal funds, in order to add a fifth Shuttle flight per year dedicated to support ISS research.

Prioritization by REMAP

Findings: As regards the prioritization of research areas by the REMAP, the SSUAS has several concerns. First, the prioritization is broad, including 14 categories as primary priorities, which will be difficult to translate into a strategic plan. Second, the SSUAS notes that there were at least three dissenting/minority opinions appended to the REMAP report.

Conclusion: These findings are of particular concern because of the potential long-term impact of this report, as well as the necessity of dealing in the next few years with the serious constraints on conducting research on the ISS, which will require difficult choices regarding priorities and strategic planning. The original charge to the Committee was to identify "high-priority, affordable science objectives." Charges were given to the Committee verbally that may have superseded the written charge. The SSUAS is disconcerted that there were these dissenting/minority opinions.

Recommendation: The SSUAS requests documentation of the charge to the REMAP, the criteria used in the prioritization, and the factual basis on which the prioritization was based. The SSUAS requests a copy of the full text of the dissenting/minority opinions, along with the full text of the REMAP Report.

Inter-Center Competition

Findings: The presentations by the investigators who flew on ISS Increments 3 and 4 indicated difficulties in contacting the POIC, reworking problems that occurred unexpectedly that affect the timeline, and gaining access to appropriate managers of protocols and processes. These difficulties in translating protocols and procedures from one Center to another cause needless increases in cost, loss of efficiency in the utilization of ISS, and reduced science return.

Conclusion: A number of these problems are caused by inter-Center divisions and nonproductive competition that prevent close integration and cross-Agency cooperation.

Recommendation: The SSUAS recommends that the Administrator and the Associate Administrator for Code U actively reduce inter-Center competition to promote cost and performance efficiencies in ISS utilization. Further, the SSUAS requests that the Associate Administrator present progress in this recommendation at its next meeting.

Scientist Managers

Findings: Investigators on Increments 3 and 4 and members of the SSUAS described difficulties with all stages of the flight approval process - including the recurrent flight justification and approval as well as the problem of having flight experiments that have been approved by peer review panels modified by the subsequent engineering reviews. In addition, many of these investigators recounted episodes of colleagues whose experiments were approved for flight by peer review panels only to be delayed so many years or times that the original experiment was terminated or became superfluous. Finally, investigators brought forward instances in which seemingly arbitrary decisions were made about flight opportunities.

Conclusion: NASA is an engineering organization that has had tremendous success with technology, but is attempting to develop and define a science agenda for ISS. As a result, managers throughout NASA exert tremendous influence over the experiments that fly and are composed primarily of engineers who may not have an in depth understanding of the science and its experimental requirements.

Recommendation: The SSUAS recommends that more scientists be included in Space Station management positions.

Express Pallets

Findings: It is still uncertain whether Brazil will fulfill its commitment to supply three Express pallets for the ISS. These pallets are required for some Earth science investigations, including SAGE-3, as well as for some commercial instruments, potential space science instruments, and others.

Conclusion: If Brazil fails to provide the Express pallets, it will be necessary for NASA to provide them in order to realize the potential of ISS to utilize the truss attach points for a variety of investigations.

Recommendation: NASA must execute the contingency plan for providing Express pallets in the event that Brazil fails to provide them as requested in the Administrator's letter to Brazil.

Cross-Enterprise Planning

Findings: The results of the REMAP Task Force are guiding NASA's research plans for biological and physical research on ISS. There are also major opportunities on ISS for research in other NASA Enterprises, including Space Science and Earth Science. The Chief Scientist has a process for Cross-Enterprise Prioritization.

Conclusion: It is essential that NASA's overall ISS utilization plan take account of research opportunities across the various Enterprises.

Recommendation: We recommend that the Cross-Enterprise planning for ISS proceed expeditiously, and that NASA's ISS plans include utilization of ISS for the other enterprises in addition to OBPR. We request briefing at the next SSUAS meeting on the results of the Cross-Enterprise Prioritization and how that prioritization has been folded into the overall utilization plan.

Onboard Science Officer

Finding: The REMAP recommended that an onboard science officer be present on each increment to assure performance of research.

Conclusion: A science officer would significantly increase the science priority and productivity on ISS.

Recommendation: The SSUAS heartily endorses the REMAP recommendation to have a science officer assigned to every expedition crew.

**BIOLOGICAL AND PHYSICAL RESEARCH ADVISORY COMMITTEE
Washington, D.C.
August 29-30, 2002**

LIST OF PRESENTATION MATERIAL¹

- 1) Report to the Biological and Physical Research Advisory Committee, Bradley Carpenter
- 2) Office of Biological and Physical Research, Mary Kicza
- 3) 2002 Annual Ethics Training for Special Government Employees, Laurie Rafferty
- 4) REMAP Task Force Results, Lou Ostrach
- 5) Space Product Development, Mark Uhlan
- 6) Mission Integration Division, Mark Uhlan
- 7) Physical Sciences Research Division Program Update, Eugene Trinh
- 8) Status of NASA Bioastronautics Programs, Guy Fogleman
- 9) Fundamental Space Biology Division Update, David Liskowsky
- 10) International Space Station Utilization Management Concept Development, Mark Uhlan
- 11) ISS Research Office of Biological and Physical Research, Neal Pellis
- 12) Strategic and Performance Planning Status, Christopher Flaherty
- 13) NEXT Briefing to the Biological and Physical Research Advisory Committee[Clain]
- 14) OBPR Public Outreach, John Emond

¹ Presentation and other materials distributed at the meeting are on file at NASA Headquarters, Code U, Washington, D.C. 20546.